$C=\sin\varphi(16{,}209.4583-.0029254M)+\cos\varphi(101{,}111.3767-.12678\ M)-1080.2307+.001874M.$

For practical application, it is desired to find the mass $M$ which is required to rotate certain known parts of a machine through the angle from $\varphi=13°$ to $\varphi=88°$ in the time $t=2''$.

## MECHANICS.

155. Proposed by M. E. GRABER. Graduate Student. Heidelberg University. Tiffin. Ohio.

A parabolic curve is placed in a vertical plane with its axis vertical and vertex downwards, and inside of it, and against a peg in the focus, and against the concave arc, a smooth uniform and heavy beam rests. Find the position of equilibrium.

156. Proposed by W. J. GREENSTREET. A. M., Editor of The Mathematical Gazette, Stroud, Eng.

Three perfectly elastic particles start from the cusp of a smooth cycloid (axis vertical, vertex down) at intervals of $t$ seconds. How long will it be to the $n$th collision?

## DIOPHANTINE ANALYSIS.

115. Proposed by LON C. WALKER, A. M., Graduate Student, Leland Stanford Jr. University. Cal.

Required the least three square integral numbers the difference between the sum of every two of them and the third shall be a square number.

## AVERAGE AND PROBABILITY.

142. Proposed by ARTEMAS MARTIN, A. M., Ph. D., LL. D., Washington, D. C.

Two points are taken at random in the arc of a semi-circle, and a third point anywhere in its base. Find the probability that the triangle formed by joining them is acute.

[Unsolved Problem 9955, *Educational Times*, London.]

## MISCELLANEOUS.

137. Proposed by L. C. WALKER, A. M., Graduate Student, Leland Stanford Jr. University, Cal.

The first transvectant of the binary cubic and its second transvectant is the *cubico-variant* of the binary cubic.

# NOTES.

Mr. Joseph Larmer, Fellow of St. John's College, Cambridge, has been elected Lucasian professor of mathematics to succeed the late Sir George Gabriel Stokes. D.

Dr. Arnold Emch, heretofore Assistant Professor of Pure and Applied Mathematics in the University of Colorado, has been promoted by the Regents to

a full Professorship of Graphics and Mathematics. Dr. Emch first came to the University in the spring of 1900. The following fall he was made an Assistant in Mathematics, and before the year closed he was elected Assistant Professor of Pure and Applied Mathematics. His recent promotion to a full Professorship brings Dr. Emch next to Professor DeLong in the Mathematical Department, and is a well-deserved recognition of his ability, faithfulness, and teaching power.

## *BOOKS.*

*Plane Geometry* by the Suggestive Method. By John A. Avery, Head of the Mathematics Department, English High School, Somerville, Mass. 8vo. Board, vi+122 pages. Boston: Benj. H. Sanborn & Co.

In this work, the demonstrations are not given in full, but are outlined by means of hints or suggestions. No figures are given but space is left under each theorem so that the pupil can fill in the figure for himself.

The book should prove valuable in the hands of teachers having time to give personal attention to the work of each pupil. F.

*A Text-Book of Field Astronomy* for Engineers. By George C. Comstock, Director of the Washburn Observatory, Professor of Astronomy in the University of Wisconsin. 8vo. Cloth, x+202 pages. Illustrated. Price $2.50. New York: John Wiley & Sons.

This work is designed chiefly for students in technical schools, where the work in Astronomy is usually a part of a course of technical and professional training of students who have no purpose to become astronomers. Such students are often ignorant of many important problems in Astronomy which are of great value to them in practical life. In this work are considered such problems which, in the opinion of the author, are most useful, among them being:

Rough Determinations of Latitude from altitude; Time and azimuth from single altitude; approximate Determinations circum-meridian altitudes for altitude; Time for single-altitude, etc. F.

*The Constructive Development of Group Theoy.* By B. S. Easton. Publications of the University of Pennsylvania, Mathematics, No. 2. iv+89 pages. Cloth. Price, 75 cents.

This monograph presents in continuous form, but omitting all proofs, the main concepts and results of abstract and substitution group theory. While the theory of linear groups is expressly excluded, some of its results are given under "systems of simple groups," pp. 83–84. An exhaustive bibliography occupies only 34 pages. The treatise proper occupies 39 pages, exclusive of the 8 pages of tables. A systematic use of abbreviations for titles and journals has enabled the author to give a vast number of references in so short a space. The monograph will appeal both to the beginner and to the specialist in group-theory. A technical review, noting some minor corrections, has been offered to the Bulletin of the American Mathematical Society. D.